

CLAIMS

What is claimed is:

- 1 1. A write element for perpendicular magnetic recording, comprising:
 - 2 a write pole terminating at a plane defining an air bearing surface and having a track
 - 3 width measured parallel to the air bearing surface;
 - 4 a return pole magnetically connected with said write pole in a back gap area and
 - 5 having a width greater than said track width;
 - 6 said write pole being one or more layers of magnetic material having a tapered
 - 7 surface portion wherein said write pole becomes progressively thicker with
 - 8 increased distance from said air bearing surface;
 - 9 a magnetic shield, magnetically connected with said return pole, and having a tapered
 - 10 surface portion substantially parallel with said tapered surface of said write pole
 - 11 and separated from said write pole by a non-magnetic write gap layer.
- 1 2. A write element as in claim 1, wherein said tapered surface of said magnetic
- 2 shield defines an angle of less than 90 degrees with respect to said air bearing
- 3 surface.

- 1 3. A write element as in claim 1, wherein said tapered surface of said magnetic
2 shield defines an angle of between 60 and 90 degrees with respect to said ABS
3 surface.
- 1 4. A magnetic write element as in claim 1, wherein said shield is configured with a
2 flared portion having a lateral width that increases with increasing distance from
3 said ABS, and wherein said flared portion initiates closer to said ABS surface
4 than tapered surface of said shield.
- 1 5. A magnetic write element as in claim 1, wherein said write pole is configured with
2 a flared portion having a lateral width that increases with increasing distance from
3 said ABS, and wherein said tapered surface initiates closer to said ABS surface
4 than said flared portion of said shield.
- 1 6. A magnetic write element as in claim 1 wherein said tapered shield further
2 includes first and second laterally flared wing portions.
- 1 7. A magnetic write element as in claim 6, wherein said laterally flared portions
2 initiate at a point closer to the ABS than said tapered portion.
- 1 8. A magnetic write element for perpendicular magnetic recording, comprising:
2 magnetic write pole having a track width and terminating at an air bearing surface
3 (ABS);

4 a magnetic return pole having a width substantially larger than said write pole,
5 said return pole being in magnetic connection with said write pole in a
6 back gap area;

7 a trailing shield, said shield having a tapered surface that is disposed adjacent to
8 said write pole and separated therefrom by a non-magnetic write gap.

1 9. A write element as in claim 8, wherein said tapered surface of said trailing shield
2 defines a plane that defines an angle of less than 90 degrees with respect to said
3 ABS.

1 10. A write element as in claim 8, wherein said tapered surface of said trailing shield
2 defines a plane defining an angle of between 60 and 90 degrees with respect to said ABS.

1 11. A write element as in claim 8 wherein said tapered shield further includes first
2 and second laterally flared wing portions.

1 12. A write element as in claim 8 wherein said laterally flared portions initiate at a
2 point closer to the ABS than said tapered portion.

1 13. A method of constructing a magnetic write element for use in perpendicular
2 magnetic recording, comprising:
3 depositing a first layer of magnetic material;
4 depositing a mask layer recessed from an air bearing surface location;

5 performing an ion milling operation resulting in a gradually tapering surface
6 extending from said mask toward said air bearing surface location;
7 removing said mask
8 depositing a layer of non-magnetic write gap material; and
9 depositing a second layer of non-magnetic material.

1 14. A method as in claim 13, wherein said ion milling operation is performed at an
2 angle of less the 80 degrees with respect to a surface of said deposited layers.

1 15. A method as in claim 13 further comprising after depositing said first layer of
2 magnetic material, depositing a layer of Ta.

1 16. A method for constructing a magnetic head for use in perpendicular recording and
2 having a tapered trailing shield, said method comprising:
3 forming a magnetic shaping layer having an end recessed from an air bearing
4 surface (ABS) location;
5 depositing a first layer of nonmagnetic material;
6 performing a first chemical mechanical polishing process to generate a planar
7 surface formed across an upper surface of said shaping layer and said non-
8 magnetic material, said non magnetic material being disposed between
9 said end of said shaping layer and said ABS location;
10 depositing a first magnetic layer;

11 depositing a second magnetic material layer, said second material layer being
12 more readily removed by ion milling than said first magnetic material
13 layer;
14 depositing a mask having an end recessed from said ABS location
15 performing an ion milling operation to form a tapered surface on said second
16 magnetic material layer, said tapered surface sloping downward from said
17 mask toward said ABS location;
18 removing said mask;
19 depositing a non-magnetic write gap layer;
20 depositing a third layer of magnetic material over said non-magnetic write gap
21 material;
22 planarizing said third layer of magnetic material; and
23 forming a return pole over above said third magnetic material layer.

1 17. A method as in claim 16, further comprising, after depositing said second
2 magnetic material layer, depositing a layer of Ta.

1 18. A method as in claim 16 further comprising, after depositing said non-magnetic
2 write gap material layer, depositing a layer of diamond like carbon.

- 1 19. A method as in claim 16, wherein said ion milling operation is performed at an
2 angle of greater than 15 degrees with respect to a normal to said first magnetic
3 material layer.